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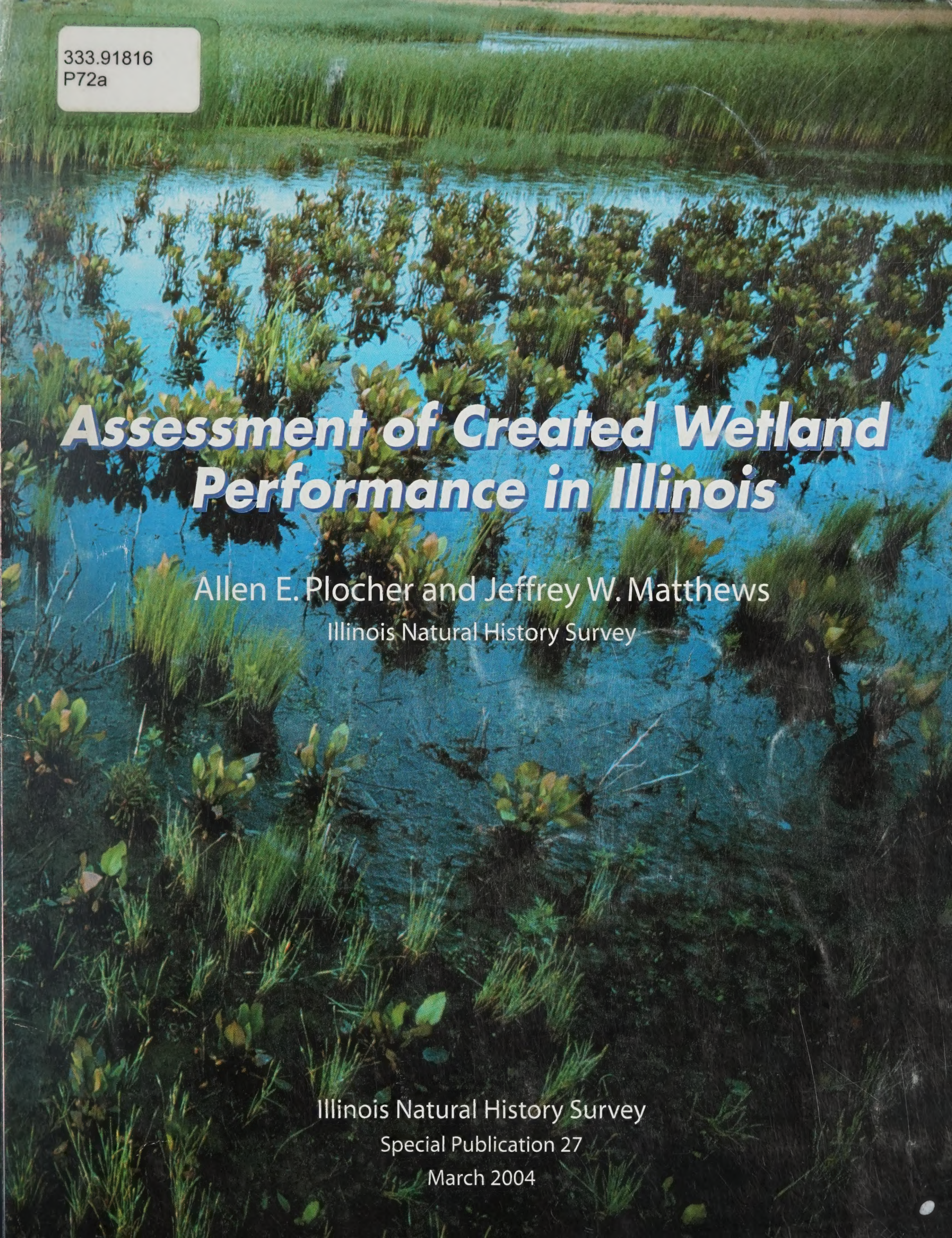

Assessment of Created Wetland Performance in Illinois

Allen E. Plocher and Jeffrey W. Matthews
Illinois Natural History Survey

Illinois Natural History Survey
Special Publication 27
March 2004

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Introduction

Wetlands are extremely valuable natural features that have decreased significantly in number over time in Illinois and the United States (Suloway and Hubbell 1994). Their important functions include flood protection, water conservation in times of drought, groundwater recharge, improvement of water quality through sediment reduction and contaminant removal, and providing habitat for native animals and plants, including many sensitive and state-listed threatened and endangered species (Mitsch and Gosselink 2000). Due to a federal "no net loss" policy on wetlands adopted through executive order by President George H. Bush in 1990, as well as a prevailing heightened interest in conservation in general, there is currently considerable interest in the restoration and creation of wetlands. Both Section 404 of the Clean Water Act of 1972 and the Swampbuster Provision of the Food Securities Act of 1985 require compensation, or mitigation, for loss of wetlands. A number of federal and state programs, such as Section 319 of the Clean Water Act and the Conservation Reserve Program within the Natural Resources Conservation Service (NRCS) encourage wetland restoration and creation. In addition, various conservation organizations, such as The Nature Conservancy and Ducks Unlimited are very active in wetland restoration.

Despite wetland restoration efforts and the national goal of no net loss, wetlands and wetland functions continue to be lost due to degradation of existing wetlands (Mitsch and Gosselink 2000, Zinn and Copeland 2001). Unfortunately, no reliable information exists on the quality of existing wetlands or on trends in wetland quality over time (Zinn and Copeland 2001). The functional quality of existing wetlands is likely decreasing in many areas due to the combined effects of habitat fragmentation, alteration of hydrology, invasive species, and continued input of nutrients and pollutants. Furthermore, it is still debatable whether created or restored wetlands can adequately replace the suite of ecological functions provided by natural wetlands (Zinn and Copeland 2001), and the failure of many wetland compensation projects contributes to a continued national net loss of wetland functions (Whigham 1999, Zedler and Callaway 1999). The need for post-construction site monitoring and assessment of created and restored wetlands to evaluate functional success is widely recognized (Kentula et al. 1992).

At this time, there is little agreement on how to assess the success or quality of wetland restorations or creations. The few functional assessment models currently available (Wetland Evaluation Technique, Hydrogeomorphic Wetland Classification) tend to be very complicated and expensive to implement and their effectiveness is debatable. We propose a very basic, quick methodology for evaluating the success of restoration/creation projects in establishing healthy wetland systems. The procedure can be applied during a single site visit or carried out periodically (i.e., biennially) to assess a site's development over time. If a single assessment is done, the site will need to have had time to develop (three to five years). Site assessments must be carried out while the growing season is well along (June through October) in order to accurately depict plant communities and the hydrologic regime affecting them. Weather patterns also need to be taken into consideration when assessing hydrology (Is a severe drought in effect? Has heavy rainfall occurred within a few days?).

Often, measurements of functional attributes are combined to provide numerical or qualitative ranking systems to determine the overall value of natural or constructed wetlands. Opponents of ranking systems point out, however, that it is impossible to compare the relative value of wetlands from different regions, that not enough is known about wetland values to accurately categorize wetlands in such a way, and that any ranking system is necessarily arbitrary (World Wildlife Fund 1992). Therefore, the method described here is only designed to assess the success or quality of a restored or created wetland in a very general way. The end result will simply be a determination that the site is poor (failing), fair (adequate), good, or very good in relation to each of several attributes. It should also be understood that a detailed comparison of the quality of one wetland to another is very difficult and subjective and such a comparison may be biased or misleading. This method should be used in only the most general sense in making these comparisons. Because wetlands of different types have different sets of functions and values, comparisons between wetlands of different types are meaningless or impossible. Finally, even though field methodology is described in some detail, it is imperative that field investigations and interpretations of findings be carried out only by qualified, experienced botanists/plant ecologists, soil scientists, and hydrologists.

Wetland functions and values can be difficult to measure directly as they are often expressed as processes or rates. Therefore, the presence or absence of certain structural elements must be used as indicators of functions (Kentula et al. 1992, Karr 1993, Angermeier and Karr 1994). Structural elements are sensitive to degradation, and are generally more fully understood and less expensive to monitor than processes (Karr 1993). An example of an element that has been used to rate the overall quality of wetlands is the presence of certain vascular plant species (Taft et al. 1997, Mack et al. 2000). To be reliable as an indicator of wetland function, an element must have small annual variability and small sample variance (Hughes et al. 1998). When using elements as indicators, one must always realize that elements are not direct measures of functional performance (Hruby 1999), and that some important wetland functions simply cannot be measured rapidly (Reed 1986).

Ideally, an assessment method for constructed wetlands should include an adaptive management component. The information gathered during the assessment should be used to reevaluate past management, and should provide information that can guide future changes in wetland design or management that can improve the functional success of the site. The information collected during an assessment should be stored in a database in order to allow synthesis of information from multiple wetland sites.

Wetland Assessment Procedure

This wetland assessment procedure describes eight general wetland attributes that can be used to evaluate the functional success of constructed wetlands. Six of these (wetland status, functional problems, realism, floristic quality, size, and landscape setting) should be assessed at every constructed wetland. The two remaining attributes (wetland type and water quality improvement) can be used in situations where the wetland is expected to fulfill specific requirements.

Wetland Status

The first and most important consideration is whether the site is a wetland. The generally accepted procedure is to use the U. S. Army Corps of Engineers' criteria for identifying jurisdictional wetlands (Environmental Laboratory 1987). A wetland must support hydrophytic vegetation, hydric soils, and wetland hydrology. There is no quality rating for this category. If the site is a wetland, it passes, if not it fails. However, if a site is being evaluated over time, a few years may be necessary for wetland hydrology, the driving force, to develop. If wetland hydrology fails to develop, various additional alterations may be attempted (e.g., diverting ditches onto the site or plugging them, breaking drain tiles, constructing a berm on the downstream end, and/or shallow (0.3 m) excavation) (Admiraal et al. 1997). It is not appropriate or effective to attempt to alter the vegetation or soils if the hydrology is inadequate.

Does the site have dominant hydrophytic vegetation? Quantitative vegetation sampling is used to describe species composition of plant communities and to ascertain species dominance for hydrophytic vegetation determination. Parallel transects are established perpendicular to the long axis of the site at regular intervals of 10 m to 50 m, with sampling points equidistantly spaced on transects at 5-m to 50-m intervals, depending on site size (sampling intensity should range from 20 to 200 plots per community type—1% to 10% of area sampled). At each sampling point, vegetation is tallied as the number of individuals or aerial coverage by species in a quadrat or plot. Herbaceous vegetation is sampled in 1-m^2 quadrats (if number of species per plot routinely exceeds 15, 0.25-m^2 quadrats may be used). Shrubs ($\geq$ 1 m tall, < 2.5 cm dbh) are sampled in 16-m^2 plots, and saplings ($\geq$ 2.5 cm, < 10 cm dbh) in 100-m^2 plots. If different community types are present, plots/quadrats should be separated (or stratified) by community type (Cox 1985, Kershaw 1973). Vegetation data are then analyzed to estimate relative frequency and relative cover, which are averaged to produce Importance Values. The dominant species in each vegetation layer are those, starting with the most abundant and arranged in decreasing order, whose sum immediately exceeds 50% of the total Importance Value, plus any additional species whose Importance Value is 20 or more. A site (or vegetation layer) with less than 20% vegetative cover does not have dominant vegetation. Hydrophytic vegetation is present if greater than 50% of the dominant species are hydrophytic (wetland indicator status FAC or wetter) (Federal Interagency Committee for Wetland Delineation 1989).

Assessment Criterion:

1) The site should have dominant hydrophytic vegetation.

Does the site have hydric soils? In many cases, the site will already have hydric soils or relict hydric soils before construction. In other cases, shallow excavation brings the soil surface (actually a subsoil) in close proximity to the water table. In these cases soils investigation will not yield much meaningful information. However, changes in soil characteristics may indicate the onset of wetter hydrologic conditions in already hydric soils. Some created wetlands are established on nonhydric soils and soils investigation will document hydric soil formation as wetland hydrology becomes established. A number of soil cores (5 to 10) should be extracted and examined for redoximorphic features in the surface horizon to 0.3 m depth or, in prairie soils (A horizon: colors of 3/3 or darker, thickness 25 cm or greater), immediately below the mollic epipedon. In general, redoximorphic features are soil chroma of 2 or less, and presence of redox concentrations or depletions. However, hydric soil determination should be made by a qualified soil scientist using the NRCS publication, *Field Indicators of Hydric Soils* (USDA/NRCS 1998). Depth to soil saturation should be noted. If the site is inundated, soils investigation is impractical and unnecessary.

Assessment Criterion:

1) The site should have hydric soils or hydrologic conditions favorable for hydric soil formation.

Does the site have wetland hydrology? Unfortunately, the only way to accurately depict the hydrologic regime of a site is to install and monitor shallow wells and stage gauges for a minimum of one hydrologic year (preferably three to five years). However, by visiting the site a couple of times during the growing season and observing hydrologic indicators (inundation or soil saturation within 0.3 m of surface, drift lines or water borne debris, wetland drainage patterns, watermarks on trees, water stained leaves, adventitious roots, and landscape position), trained hydrologists may be able to determine whether the wetland hydrology criterion is satisfied: inundation (to a depth of less than 2 m) or soil saturation for at least 20 days during the growing season.

Assessment Criterion:

1) The site should have wetland hydrology.

Functional Problems

Does the site have functional problems? Even though the site may be a wetland, it may have attributes that diminish its functional capabilities (flood control, groundwater recharge, water quality improvement, native species habitat).

Is the vegetation unacceptable? If, after a few years, the dominant species at a site are weedy or exotic, or if the majority of species present are exotic, this is usually an indication that the site has other functional problems (Figs. 1, 2, 3, 4). The site may have poor water quality (high sediment or nutrient load) or an unnatural hydrologic regime. Again, there is no quality rating here. Either the site fails or passes on vegetation. However, several years may be necessary to develop acceptable vegetation. Planting or seeding of appropriate species may speed up the process (Admiraal et al. 1997). Since some weedy or exotic species may form dense stands and become persistent, herbiciding or mowing may be necessary.

Assessment Criteria:

1) Exotic or weedy species should not be among the three most dominant species in any vegetation layer (herb, shrub, sapling, or tree).
2) Not more than 50% of the species present should be exotic.

Is the site too small for the wetland? Often, a desire to attempt the maximum wetland acreage possible will result in squeezing to the very edge of an available site (Fig. 5). Generally, this will negatively affect the site quality and level of success to varying degrees and result in low performance in other categories. Many wetland organisms are dependent upon surrounding upland habitat (Pearson 1994). However, upland habitat is rarely considered in the design of wetland preserves (Whited et al. 2000).

Assessment Criteria:

1) The site should not have an insufficient watershed or water source (as indicated by absence of indicators of wetland hydrology or evidence of water source). The result will be nonwetland or marginal wetland status.
2) The site should not have an insufficient buffer of natural vegetation (< 15 m). The result may be excessive erosion and sedimentation (see below), or an unacceptable species composition.
3) Industrial or commercial development or highways should not be too close (< 30 m). Same result as (2). Retention basins should be constructed to intercept runoff from nearby development.
4) Steeply sloping uplands (≥ 1:5) should not be within 30 m of the wetland on more than one side. The result may be an unnatural hydrologic regime (see below).

Is the slope of the bank too steep? A steep bank may result in nonwetland status or limited area with wetland status (a pond with a narrow emergent fringe) (Fig. 6). An unnatural hydrologic regime (see below) may develop.

Assessment Criterion:

1) Slope of the bank should be no steeper than 1:10.

Is erosion, scouring, sedimentation, or bare soil (other than exposed flats at low water) apparent? These conditions result from either too small a buffer or input from flashy streams or ditches (see below). Buffers can be improved, flashy waterways cannot, but in rare cases may be diverted from the site.

Assessment Criterion:

1) Erosion, scouring, sedimentation, or bare soil should not be apparent (≥ 10% of area) or extensive (≥ 30% of area). If apparent, remediation is necessary, if extensive, the site fails.

Is the hydrologic regime (water level and fluctuation) unnatural? Wetland species are adapted to water levels that fluctuate to varying degrees over time. Wetlands are inundated or saturated for a significant part of the year, occasionally to consider-

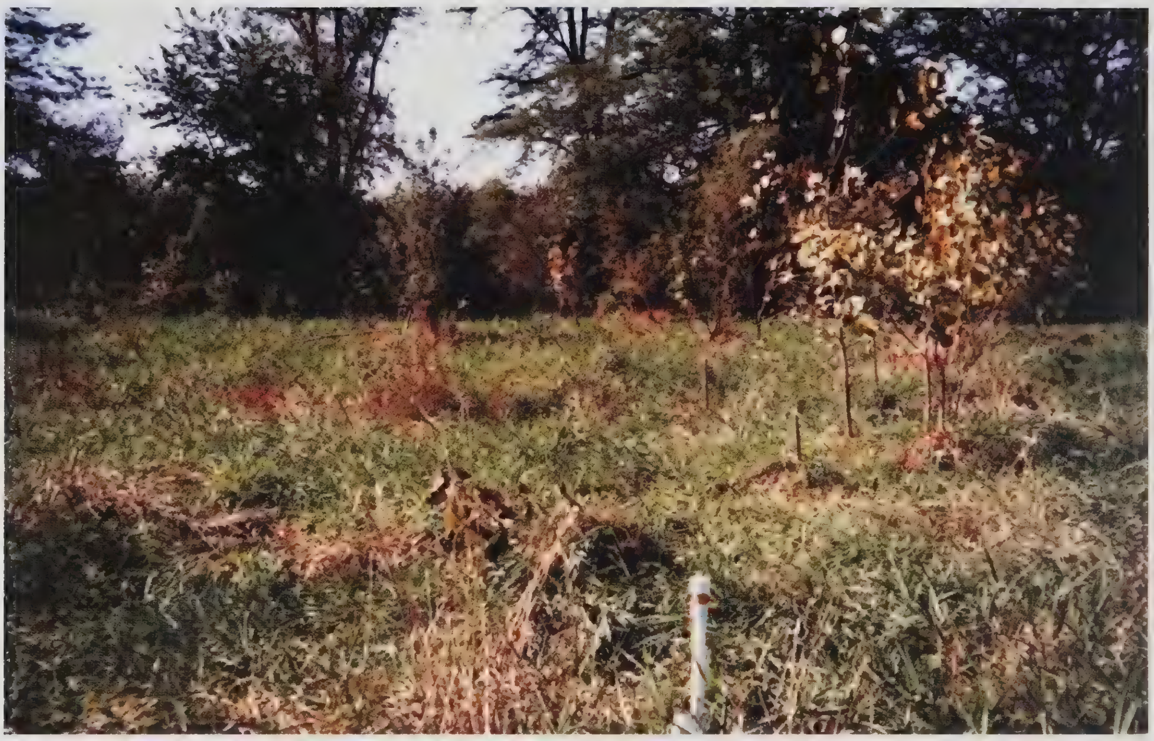

Figure 1. Unacceptable vegetation—reed canary grass (*Phalaris arundinacea*).

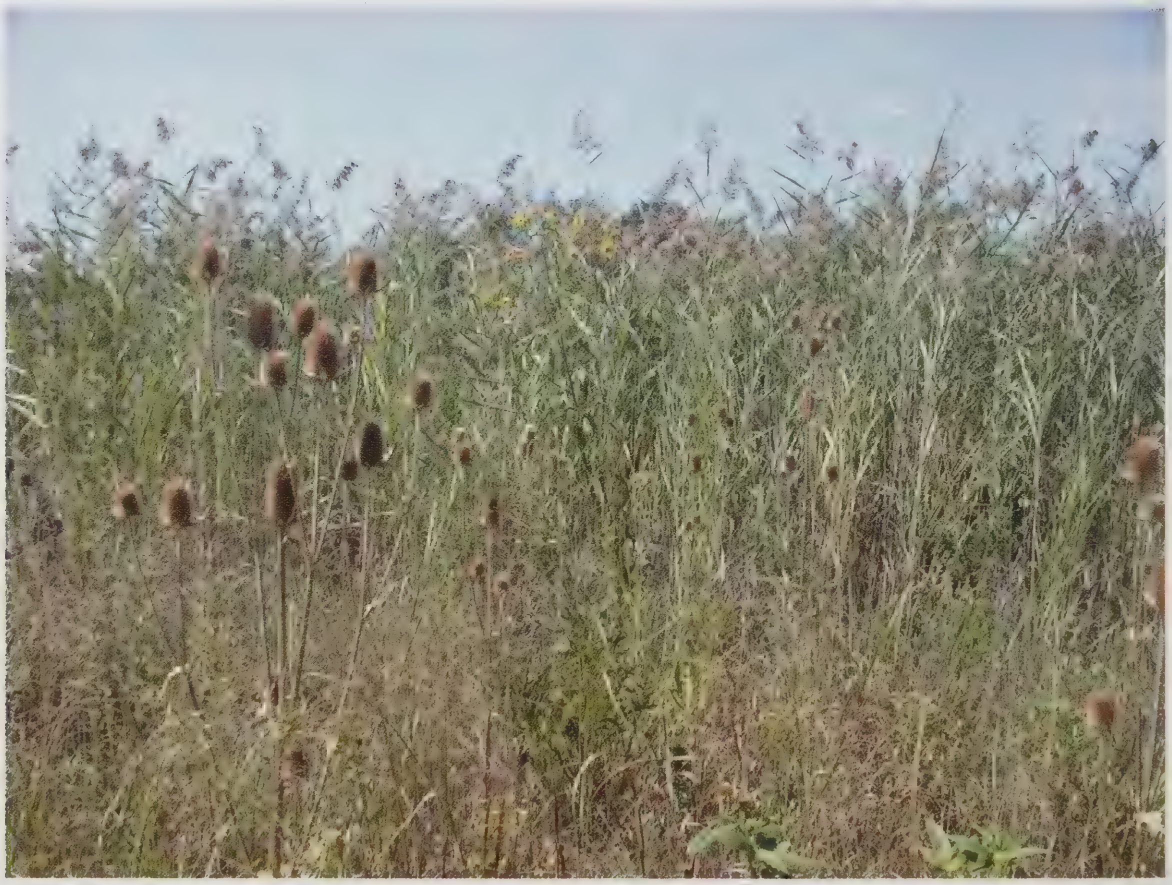

Figure 2. Unacceptable vegetation—giant reed (*Phragmites australis*), invasive, and teasel (*Dipsacus* sp.), exotic.

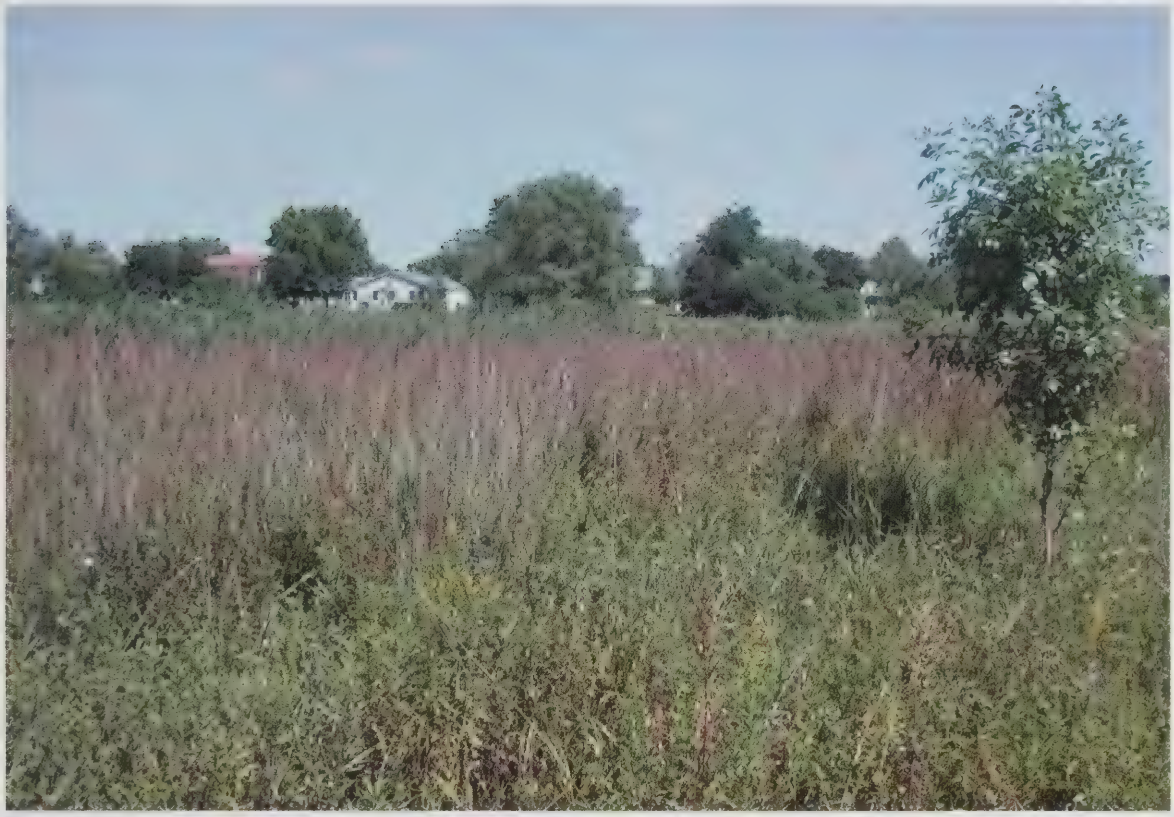

Figure 3. Unacceptable vegetation—purple loosestrife (*Lythrum salicaria*), exotic, and Canada goldenrod (*Solidago canadensis*), a weedy upland species.

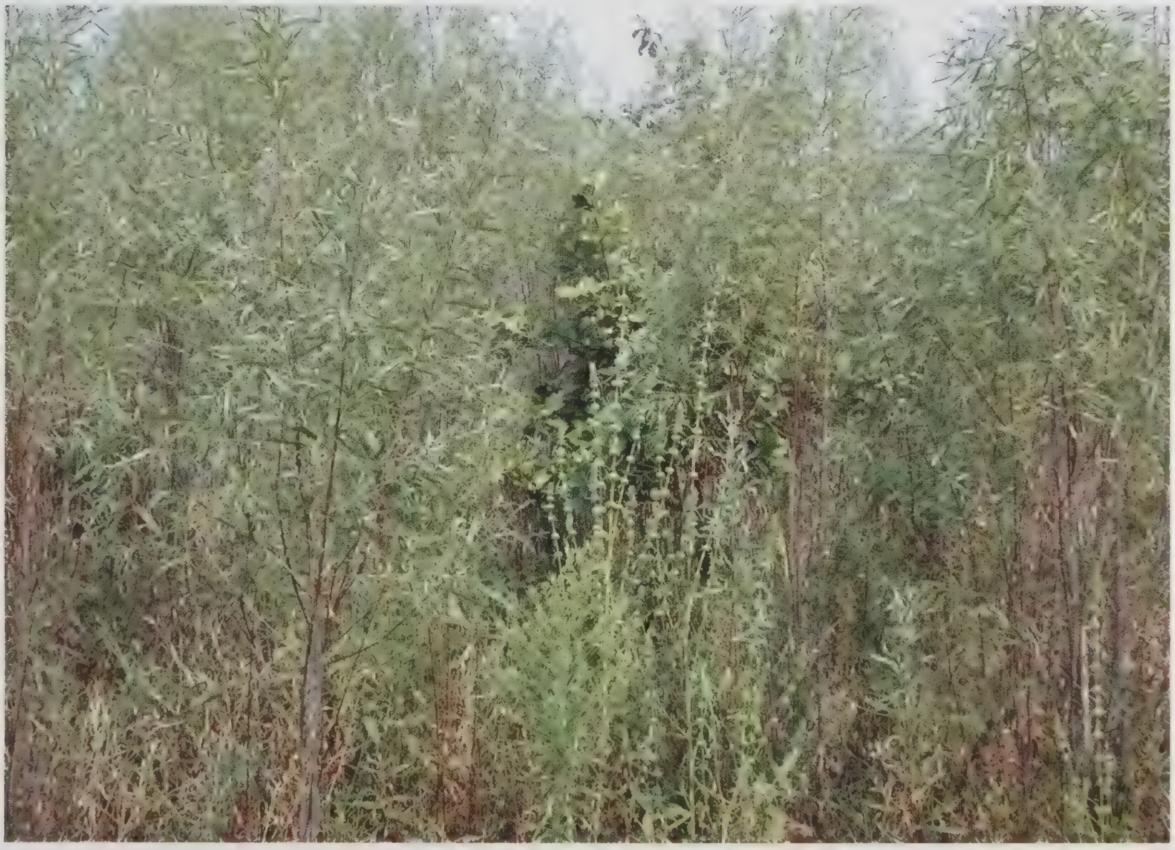

Figure 4. Unacceptable vegetation—sandbar willow (*Salix exigua*) outcompeting planted oaks.

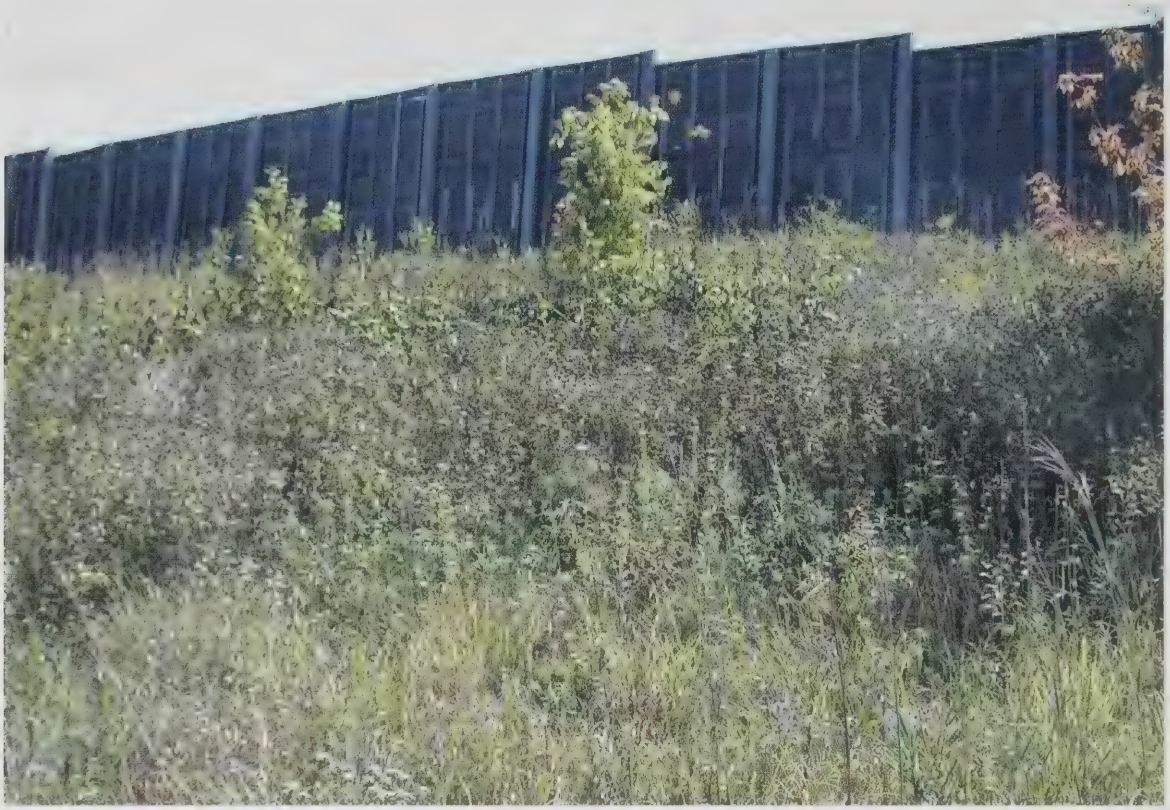

Figure 5. Insufficient watershed—highway too close, surrounded by steeply sloping uplands.

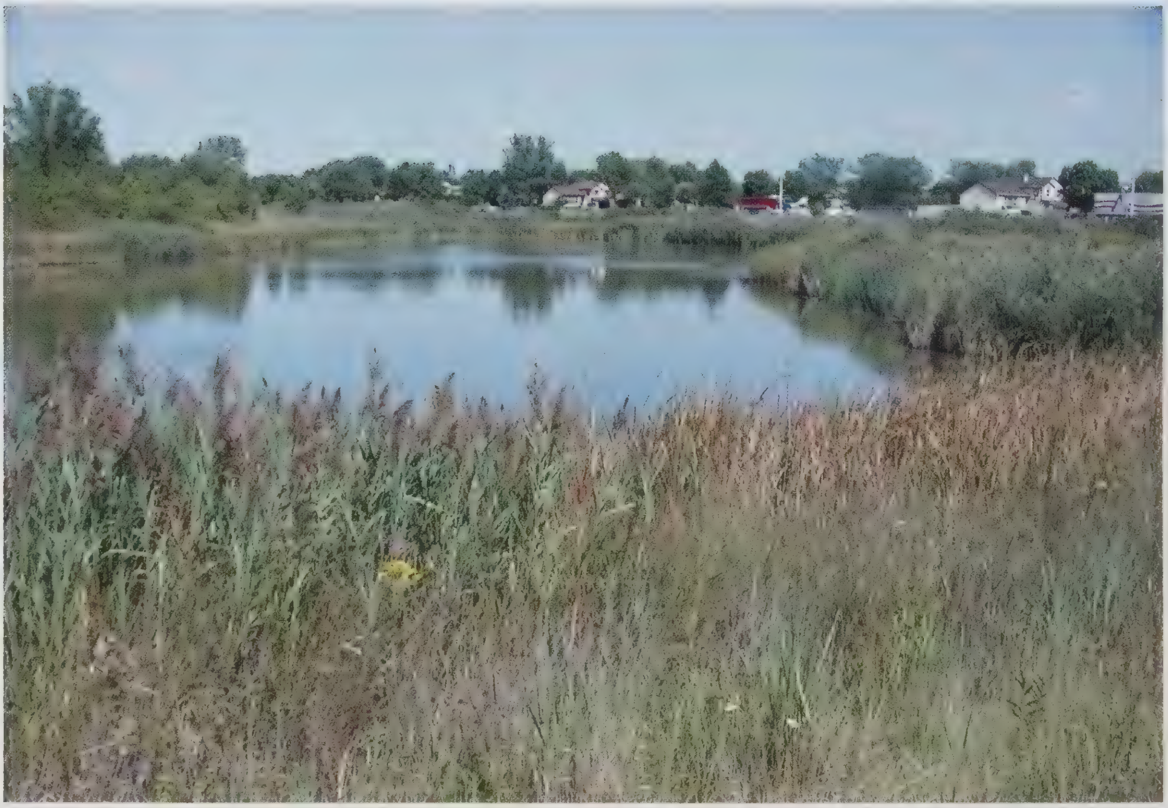

Figure 6. Slope of bank too steep—narrow wetland fringe.

able depths for brief periods. However, water levels usually rise and fall gradually. All wetlands, at least occasionally, experience drawdowns (dry out completely), a process necessary for the reproduction of many wetland plants. The seasonality of wet and dry periods varies geographically. Each region's wetland flora and fauna are adapted to that seasonality. If a site has insufficient water, it, of course, will not be a wetland. Several studies have shown that the most common problems in wetland restoration result from too much water (excessive depth, overabundant open water, lack of fluctuation), which results in sparse or no vegetation or dominance by a few weedy or exotic species (Mitsch and Gosselink 2000, Kentula et al. 1992). Some sites, influenced by reservoirs, locks and dams, or with water control structures operated to attract migratory waterfowl, are artificially flooded during the dry season. This also often results in sparse vegetation or dominance by exotic species. If watercourses drain heavily agricultural or developed areas, they tend to increase dramatically in flow immediately following precipitation events and then quickly recede. Wetlands influenced by such sudden influxes and outfluxes of high energy water are said to have flashy hydroperiods. This results in extensive erosion, scouring, and sedimentation. The vegetation tends to be weedy, with frequent bare areas (Fig. 7). An unnatural hydrologic regime is difficult to demonstrate without hydrologic monitoring. However, trained hydrologists may detect evidence during site visits.

Assessment Criteria:

1) The site should not have too much water/lack of fluctuation. (Evidence: steep banks and persistent, deep [≥ 0.6 m] water.)
2) The site should not have high water in an inappropriate season. (Evidence: deep standing water or evidence of recent, deep flooding in summer [other than after heavy storm events], observation of associated reservoir, lock and dam or water control structures, and waterfowl management.)
3) The site should not have a flashy hydroperiod. (Evidence: extensive erosion, scouring, sedimentation, and bare areas, observation of associated entrenched, channelized streams or ditches, and heavily agricultural or developed landscape.)

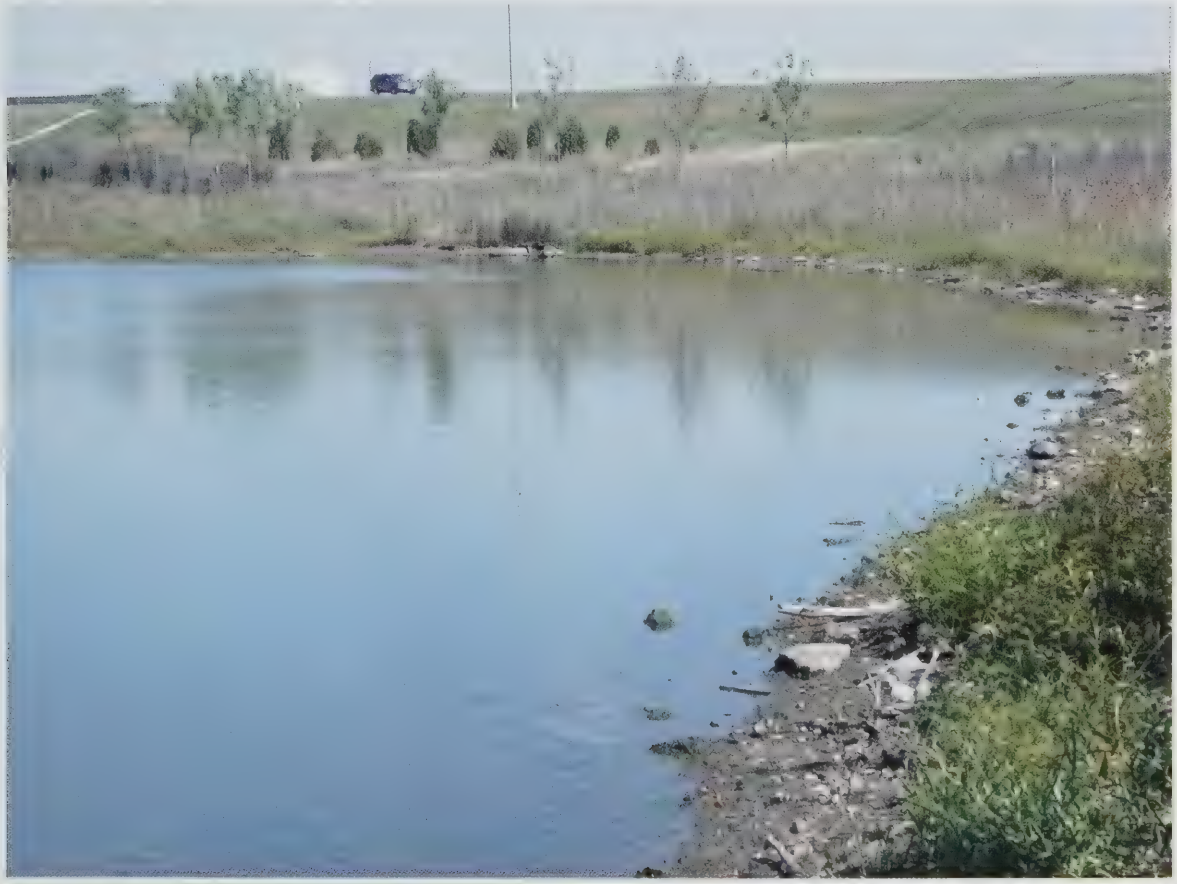

Figure 7. Un-natural hydrologic regime—steep banks, persistent deep water, scouring.

Realism

Does the site have realism? In other words, does it resemble naturally occurring wetlands in the region? In the extreme case, a constructed wetland could be of a type that does not exist in the geographic region. Examples would be bald cypress swamps (*Taxodium distichum*) in northern Illinois or speckled alder thickets (*Alnus incana*) in the south, or other plant assemblages not native to the location. In this case, the wetland fails. Some existing wetland types in a region are extremely difficult or impossible to create or restore. Bogs, fens, and seeps fall in this category. Some types of wetlands are common in some parts of Illinois but rare or absent in others. Wetlands associated with naturally occurring ponds are abundant in the heavily glaciated northern part of the state but, other than oxbows in floodplains, are rare or absent in the unglaciated southern portion. Other attributes increase the quality of wetlands but are not required for their success. For instance, an irregular boundary or shape is more desirable than a geometric one (rectangle, triangle, circle). A hemi-marsh, a marsh with a significant portion of open water (20%–50%) interspersed at multiple locations, is much more valuable for wildlife than is a solid stand of vegetation adjacent to an unbroken expanse of water.

Assessment Criteria:

1) Planted species should be known from the region and wetland type. Otherwise, the site fails.
2) The site should not be a pond constructed in the unglaciated southern region.
3) The wetland should have an irregular margin (wetland should not be square, round, or triangular).
4) The site should be either: *a*) riverine (open floodplain, floodplain depression) or *b*) nonriverine (upland depression, broad flat or toe of slope).
5) The community type should be: *a*) forested, *b*) scrub/shrub, *c*) emergent, or *d*) aquatic bed.
6) If emergent, open water should be interspersed at multiple locations (hemi-marsh).

Floristic Quality

What is the natural quality of the vegetation? Recently created or restored sites will support plant communities made up of aggressive, early successional native species adapted to colonizing disturbed areas. Exotic species are also common under these conditions. As the site stabilizes and matures over time, most of these, often short-lived, species are replaced by more conservative, stable, less disturbance adapted, later successional species. The site is said to have reached a later successional stage, and is supporting species subjectively regarded as higher in natural quality. It is desirable that created or restored wetlands move as rapidly as possible from a disturbed, early successional state to a more stable, later successional state with higher natural quality. Planting or seeding native species appropriate for the wetland type and region (Admiraal et al. 1997) may speed the process along. In some cases, herbiciding or mowing dense stands of exotic species may be necessary. This category may be evaluated periodically (annually, biennially). For instance, the U.S. Army Corps of Engineers requires annual monitoring for five years. Ten years or more may be necessary to assess forested wetland development. If evaluated only once, the site should be visited after a period of stabilization has been allowed (three to five years). As with unacceptable vegetation, a site with very low Floristic Quality after several years is usually experiencing other problems related to water quality or hydrologic regime.

The site should be investigated in the latter part of the growing season (July–October, June–July for *Carex* spp.) and a plant species list compiled. The Floristic Quality Assessment Method (Taft et al. 1997) should be utilized and applied in a very general way. This index should not be used as a substitute for quantitative analysis, but it does provide a measure of floristic integrity. Each species native to Illinois is given a numerical rating (coefficient of conservatism, C) from 0 to 10 based on the species' affinity for relatively undisturbed habitats or very restricted distribution. The Floristic Quality Index (FQI) is calculated as follows: $I=R/\sqrt{N}$, where R represents the sum of the numerical ratings for all species recorded in the area, and N represents the number of recorded native species. The mean coefficient of conservatism (mean C) is calculated as: mean $C=R/N$. FQI values of less than 10 indicate low natural quality, while sites with values of 20 or more (mean $C \geq 3.0$) have at least some evidence of native character and may be considered environmental assets. Keep in mind that floristic quality comparisons between different community types may not be appropriate, and that wetlands in urban environments or where water quality and flood control are of primary importance have values unrelated to natural quality. Nevertheless, the following generalizations apply: In general (but not necessarily every year) FQI should increase over time. In forest restorations, keep in mind that species diversity and floristic quality will often drastically decrease when the sapling canopy closes (approximately age 10 to 25) and then increase again. A site with FQI value of less than 10 after a few years is of poor natural quality and may be considered to have failed. A site's achievement of an FQI value of 20 or more in five years is considered to be an excellent result.

Assessment Criteria:

1) FQI should generally increase over time.
2) Floristic quality can be characterized as

poor (<10.0), adequate (≥10.0<15.0), good (≥15.0< 20.0), or very good (≥ 20.0).

Size

What is the size of the site? This characteristic depends heavily on the purpose of the site and resources available to the owner. In general, a larger site is of more value than a smaller site for such functions as flood control, water quality, floristic quality, and wildlife habitat. However, a small site of very high floristic quality may be more desirable than a large site of very low quality. Small sites (ephemeral and fish free) are better for certain functions, such as amphibian reproduction (Sexton and Phillips 1986). In heavily urbanized or agricultural areas, the relative value of smaller sites increases. In general, a site smaller than 0.1 acre (0.04 ha) is of little value. A site of 20 acres (8 ha) or more is of considerable environmental worth. However, some subjectivity should be used in assessing the value of a wetland based on its size.

Assessment Criterion:

1) The size of the site can be characterized as: *a*) < 0.1 acre (very low value), *b*) ≥ 0.1 acre and < 1 acre (low), *c*) ≥1 acre and <10 acres (fair), *d*) ≥10 acres and < 20 acres (good), or *e*) ≥ 20 acres (very good).

Landscape Setting

Construction of wetlands without consideration of the surrounding landscape can result in sites being isolated within a matrix of altered habitat (Pearson 1994). Many important wetland functions are dependent upon factors outside the boundaries of the wetland itself. For example, wetland functions are largely dependent upon hydrologic inputs, outputs, and the landscape setting of the wetland. Complex interactions between wetland vegetation, position within the watershed, hydrologic flow through the wetland, and other factors determine the capacity of a wetland to improve water quality and moderate flood events (Bastain and Benforado 1988, Kittelson 1988).

Is the site in an upper or lower position in watershed; is it riverine or depressional? This mainly relates to how the wetland functions. In particular, it relates to flood control and water quality attributes, in which case upper watershed, riverine would be best.

Assessment Criteria:

1) The watershed position of the site can be characterized as: *a*) in the upper watershed (good), *b*) in the middle watershed (fair), or *c*) in the lower watershed (poor).
2) The hydrologic setting of the site can be characterized as: *a*) riverine (good) or *b*) depressional and isolated (poor).

Is the site close to other wetlands? Wetland-dependant plants and animals depend on hydrologic or vegetative connectivity among wetlands for dispersal. Population viability may depend on such dispersal, especially in regions where wetlands tend to be small (Pearson 1994). The ability of a wetland to provide habitat for wetland-dependant birds has been shown to be partially dependant upon the amount of wetland acreage nearby, habitat connections between wetlands, and surrounding land use (Whited et al. 2000, Fairbairn and Dinsmore 2001). For absolute natural quality and habitat values, wetlands near other wetlands are of higher value since they expand habitat and provide migration corridors.

Assessment Criteria:

1) The site should be connected to other wetlands via a hydrologic connection and associated corridor of natural vegetation.
2) The setting of site can be characterized as having: *a*) no wetlands within a 0.4-km radius (no value), *b*) < 5 ha of wetlands within a 0.4-km radius (poor), *c*) > 5 ha, but < 15 ha (fair), or *d*) > 15 ha (good).

Is the site in an anthropogenic setting (urban or agricultural landscape)? Generally, wetlands located within an anthropogenic setting have lower natural quality and habitat values than those surrounded by natural land. On the other hand, for both wildlife habitat and water quality functions, wetlands in urban or heavily agricultural landscapes have special value. In these areas, smaller wetlands, those isolated from natural land and those lower in natural quality, have increased values in relative terms. With almost no natural land present to provide wildlife and native plant habitat and water quality and flood control value, any such land is all the more valuable. Therefore, some subjectivity should be used when evaluating the following criteria.

Assessment Criteria:

1) The site should be connected to (or close to) other natural land via a corridor of natural vegetation.
2) The setting of the site can be characterized as having: *a*) no natural land within a 1.6-km radius (no value), *b*) < 40 ha of natural land within a 1.6-km radius (poor), *c*) > 40 ha but < 200 ha (fair), or *d*) > 200 ha (good).

The following categories only apply if the site has specific requirements.

Wetland Type

In certain cases, a specific wetland type is desired. If so, the site should be evaluated to determine whether the appropriate wetland type has been established. Existing wetlands of the desired type in the vicinity of the constructed wetland help in meeting this goal because they act as a seed source.

Is a forested wetland required at the site? The following assessment criteria should be met if a forested wetland is required.

Assessment Criteria:

1) Planted tree survival should be 30%–60% and density should be ≥ 400 stems/acre after several years (Figs. 8 and 9). Less than 400 stems/acre at five years is considered a failure.

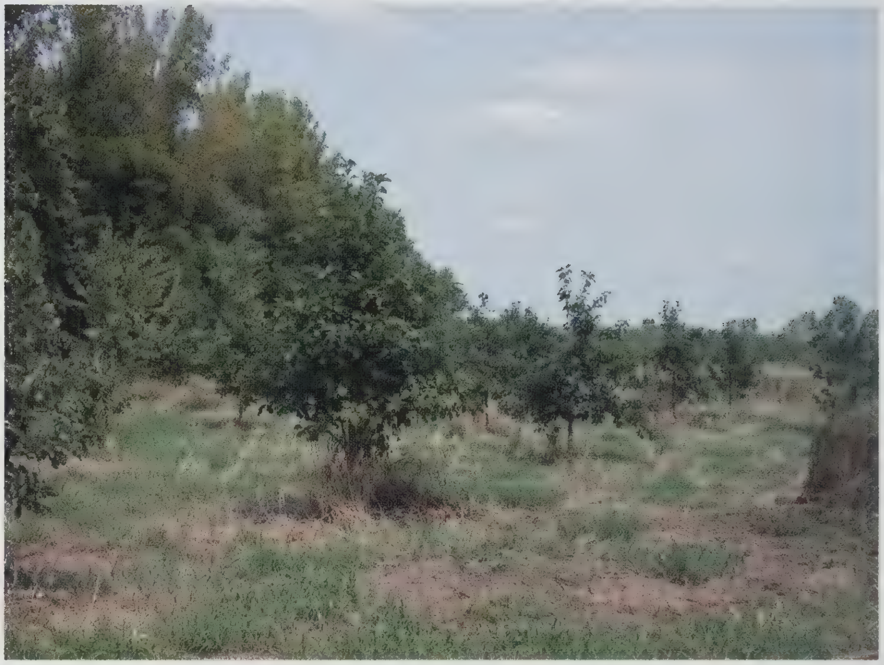

Figure 8. Successful forested wetland — good survival and growth of planted swamp white oak (*Quercues bicolor*).

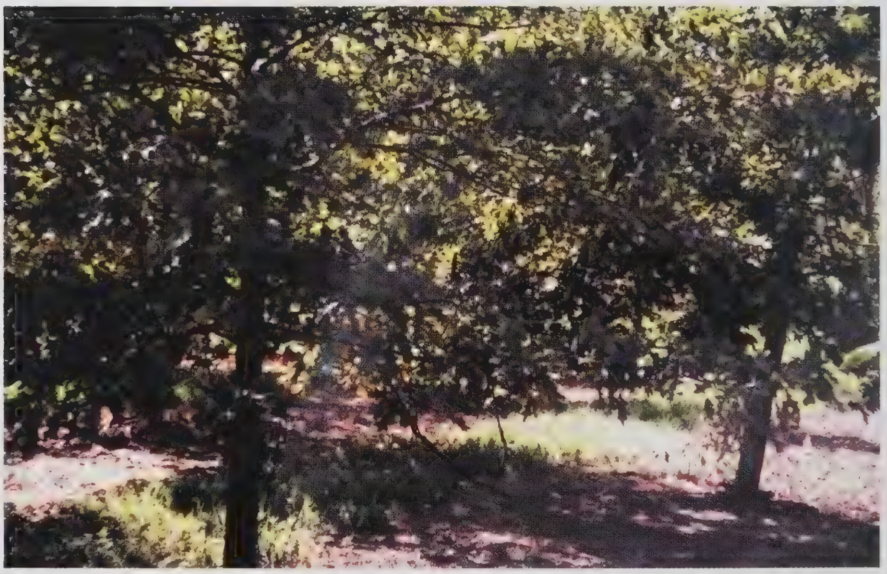

Figure 9. Successful forested wetland— good survival and growth of pin oak (*Quercus palustris*).

2) Natural tree regeneration should be at least 400 stems/acre if planting is carried out, 800/acre with no planting.
3) Existing forest should be nearby.

Is a scrub-shrub wetland required at the site? The following assessment criteria should be met if a scrub-shrub wetland is required. Note: a stand of young trees should not be confused with a scrub-shrub wetland.

Assessment Criteria:

1) Planted shrub survival should be 30%–60% and density should be ≥ 800 stems/acre after several years. Less than 800 stems/acre at five years is considered a failure.
2) Natural shrub regeneration should be at least 800 stems/acre if planting is carried out, 1600/acre with no planting
3) Tree encroachment should be no more than 25% areal coverage and ≤ 200 stems/acre.

Is an emergent wetland required at the site? The following assessment criteria should be met if an emergent wetland is required.

Assessment Criteria:

1) At least 50% of planted emergent species should be represented by live, healthy individuals after several years (Figs. 10 and 11). Less than 50% of planted species alive at five years is considered a failure.

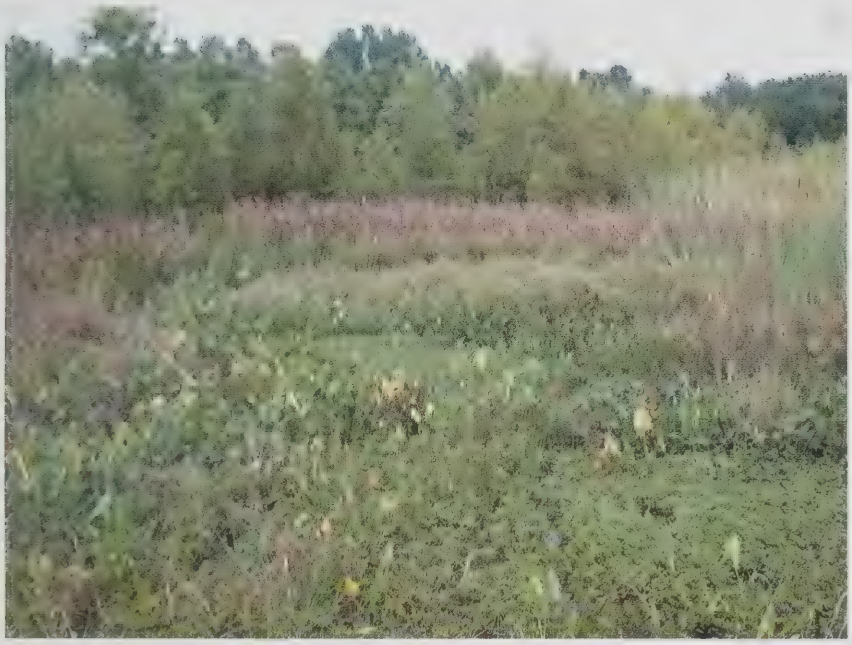

Figure 10. Successful emergent wetland — good survival of arrowhead (*Sagittaria latifolia*) and pickerelweed (*Pontederia cordata*).

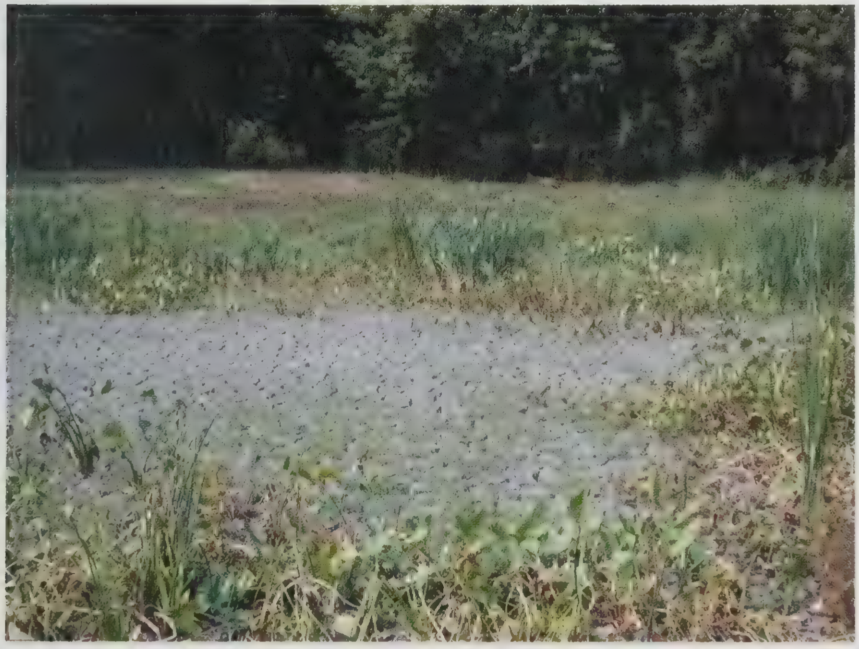

Figure 11. Successful emergent wetland — good survival of arrowhead (*Sagittaria latifolia*) and great bulrush (*Scirpus tabernaemontanii*).

2) Natural colonization by emergents should contribute to a total of at least 50% ground cover. Less than 50% areal coverage by emergents at five years is considered a failure.
3) Tree or shrub encroachment should be less than 25% areal coverage or ≤ 200 stems/acre (trees), ≤ 400 stems/acre (shrubs).

Is an aquatic bed wetland required at the site? The following assessment criteria should be met if an aquatic bed wetland is required.

Assessment Criteria:

1) At least 50% of planted species should be represented by live, healthy individuals after several years. Less than 50% of planted species alive at five years is considered a failure.
2) Natural colonization by floating or submerged aquatics should contribute to a total of at least 25% cover. Less than 25% cover of floating or submerged aquatics at five years is considered a failure.
3) Emergent encroachment should be < 50% cover.

Water Quality Improvement

In certain cases, constructed wetlands are required to carry out water quality improvement or sedimentation abatement functions. If so, the site should be evaluated using the following assessment criteria to determine whether the site has the capability to perform these functions.

Assessment Criteria:

1) The site should be large (≥ 5 acres). However, the desired size is related to the projected volume of incoming water (i.e., retention time of incoming water should be measured in days, not hours).
2) Vegetation must be persistent (standing through winter). It should be either: *a*) shrubs or saplings, or *b*) cattails, bulrushes, giant reed, or cordgrass.
3) Vegetation must be taller than maximum high water.
4) Bare ground (> 10% areal cover) or steep banks (> 1:10) are unacceptable.
5) The site must be in the correct landscape position to effectively intercept sediment or polluted water. (It should be in the upper part of the watershed, downstream from pollution source, and upstream from feature or point where improved water quality is needed.)
6) The site should be riparian.

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Created Wetland Assessment Form

Wetland Status

Does the site have dominant hydrophytic vegetation?

Assessment Criterion:

1) The site should have dominant hydrophytic vegetation. (pass/fail)

Does the site have hydric soils?

Assessment Criterion:

1) The site should have hydric soils or hydrologic conditions favorable for hydric soil formation. (pass/fail)

Does the site have wetland hydrology?

Assessment Criterion:

1) The site should have wetland hydrology by fifth year. (pass/fail)

Functional Problems

Is the vegetation unacceptable?

Assessment Criteria:

1) Exotic or weedy species should not be among the three most dominant species in any vegetation layer (herb, shrub, sapling, or tree). (pass/fail)

2) Not more than 50% of the species present should be exotic. (pass/fail)

Is the site too small for the wetland?

Assessment Criteria:

1) The site should not have an insufficient watershed or water source (as indicated by absence of indicators of wetland hydrology or evidence of water source).

2) The site should not have an insufficient buffer of natural vegetation (< 15 m).

3) Industrial or commercial development or highways should not be too close (< 30 m). Retention basins should be constructed to intercept runoff from nearby development.

4) Steeply sloping uplands (≥ 1:5) should not be within 30 m of the wetland on more than one side. The result may be an unnatural hydrologic regime.

Is the slope of the bank too steep?

Assessment Criterion:

1) Slope of the bank should be no steeper than 1:10. (pass/fail)

Is erosion, scouring, sedimentation, or bare soil (other than exposed flats at low water) apparent?

Assessment Criterion:

1) Erosion, scouring, sedimentation, or bare soil should not be apparent (≥ 10% of area) or extensive (≥ 30% of area). If apparent, remediation is necessary, if extensive, the site fails.

Is the hydrologic regime (water level and fluctuation) unnatural?

Assessment Criteria:

1) The site should not have too much water/lack of fluctuation. (Evidence: steep banks and persistent, deep [≥ 0.6 m] water.)

2) The site should not have high water in an inappropriate season. (Evidence: deep standing water or evidence of recent, deep flooding in summer [other than after heavy storm events], observation of associated reservoir, lock and dam, water control structures or waterfowl management.)

3) The site should not have a flashy hydroperiod. (Evidence: extensive erosion, scouring, sedimentation, and bare areas; observation of associated entrenched, channelized streams or ditches, and heavily agricultural or developed landscape.)

Realism

Assessment Criteria:

1) Planted species should be known from the region and wetland type. (pass/fail)

2) The site should not be a pond constructed in an unglaciated southern region.

3) The wetland should have an irregular margin (wetland should not be square, round, or triangular).

4) The site should be either: *a*) riverine (open floodplain, floodplain depression) or *b*) nonriverine (upland depression, broad flat or toe of slope).

5) The community type should be: *a*) forested, *b*) scrub/shrub, *c*) emergent, or *d*) aquatic bed.

6) If emergent, open water should be interspersed at multiple locations (hemi-marsh).

Floristic Quality

Assessment Criteria:

1) FQI should generally increase over time.

2) Floristic quality can be characterized as poor (<10.0), adequate (≥10.0<15.0), good (≥15.0< 20.0), or very good (≥ 20.0).

Size

Assessment Criterion:

1) Size of the site can be characterized as: *a*) < 0.1 acre (very low value), *b*) ≥ 0.1 acre and < 1 acre (low), *c*) ≥1 acre and <10 acres (fair), *d*) ≥10 acres and < 20 acres (good), or *e*) ≥ 20 acres (very good).

Landscape Setting

Is the site in an upper or lower position in watershed; is it riverine or depressional?

Assessment Criteria:

1) The watershed position of the site can be characterized as: *a*) in the upper watershed (good), *b*) in the middle watershed (fair), or *c*) in the lower watershed (poor).

2) The hydrologic setting of the site can be characterized as: *a*) riverine (good) or *b*) depressional and isolated (poor).

Is the site close to other wetlands?

Assessment Criteria:

1) The site should be connected to other wetlands via a hydrologic connection and associated corridor of natural vegetation.

2) The setting of site can be characterized as having: *a*) no wetlands within a 0.4-km radius (no value), *b*) < 5 ha of wetlands within a 0.4-km radius (poor), *c*) > 5 ha but < 15 ha (fair), or *d*) > 15 ha (good).

Is the site in an anthropogenic setting (urban or agricultural landscape)?

Assessment Criteria:

1) The site should be connected to (or close to) other natural land via a corridor of natural vegetation.

2) The setting of site can be characterized as having: *a*) no natural land within a 1.6-km radius (no value), *b*) < 40 ha of natural land within a 1.6-km radius (poor), *c*) > 40 ha but < 200 ha (fair), or *d*) > 200 ha (good).

Form for Sites with Specific Requirements

Wetland Type

Is a forested wetland required at the site?

Assessment Criteria:

1) Planted tree survival should be 30%–60% and density should be ≥ 400 stems/acre after several years. Less than 400 stems/acre at five years is considered a failure.

2) Natural tree regeneration should be at least 400 stems/acre if planting is carried out, 800/acre with no planting.

3) Existing forest should be nearby.

Is a scrub-shrub wetland required at the site? Note: a stand of young trees should not be confused with a scrub-shrub wetland.

Assessment Criteria:

1) Planted shrub survival should be 30%–60% and density should be ≥ 800 stems/acre after several years. Less than 800 stems/acre at five years is considered a failure.

2) Natural shrub regeneration should be at least 800 stems/acre if planting is carried out, 1,600/acre with no planting.

3) Tree encroachment should be less than 25% areal coverage and ≤ 200 stems/acre.

Is an emergent wetland required at the site?

Assessment Criteria:

1) At least 50% of planted emergent species should be represented by live, healthy individuals after several years. Less than 50% of planted species alive at five years is considered a failure.

2) Natural colonization by emergents should contribute to a total of at least 50% ground cover. Less than 50% areal coverage by emergents at five years is considered a failure.

3) Tree or shrub encroachment should be less than 25% areal coverage or ≤ 200 stems/acre (trees), ≤ 400 stems/acre (shrubs).

Is an aquatic bed wetland required at the site?

Assessment Criteria:

1) At least 50% of planted species should be represented by live, healthy individuals after several years. Less than 50% of planted species alive at five years is considered a failure.

2) Natural colonization by floating or submerged aquatics should contribute to a total of at least 25% cover. Less than 25% cover of floating or submerged aquatics at five years is considered a failure.

3) Emergent encroachment should be < 50% cover.

Water Quality Improvement

Assessment Criteria:

1) The site should be large (≥ 5 acres). However, the desired size is related to the projected volume of incoming water (i.e., retention time of incoming water should be measured in days, not hours).

2) Vegetation must be persistent (standing through winter). It should be either: *a*) shrubs or saplings, or *b*) cattails, bulrushes, giant reed, or cordgrass.

3) Vegetation must be taller than maximum high water.

4) Bare ground (> 10% areal cover) or steep banks (> 1:10) are unacceptable.

5) The site must be in the correct landscape position to effectively intercept sediment or polluted water. (It should be in the upper part of the watershed, downstream from pollution source, and upstream from feature or point where improved water quality is needed.)

6) The site should be riparian.

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